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WOOD, PHILLIPS, KATZ, CLARK & MORTIMER  
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SUITE 3800  
CHICAGO, IL 60661

EXAMINER

GELLNER, JEFFREY L

ART UNIT PAPER NUMBER

3643

DATE MAILED: 01/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/081,674

Applicant(s)

RUIZ ET AL.

Examiner

Jeffrey L. Gellner

Art Unit

3643

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 25 October 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,8,9,12-16,18,23 and 24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 16 and 23 is/are allowed.
- 6) ☒ Claim(s) 1,8,12-15 and 24 is/are rejected.
- 7) ☒ Claim(s) 9 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 25 October 2004.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☒ Other: See Continuation Sheet.

Continuation of Attachment(s) 6). Other: translations in English of Matsunaga (JP11-229260 A) and Harda et al. (JP402117322 A).

## DETAILED ACTION

### *Claim Objections*

Claim 1 is objected to because of the following informality:

In claim 1, line 6, “100<sup>2</sup>gr/m<sup>2</sup>” should probably be --100 gr/ m<sup>2</sup>--. The meaning of the superscripted “2” after the 100 is unclear.

Appropriate correction is required.

### *Claim Rejections - 35 USC § 112*

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 12-15 and 24 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 12-15 and 24 are indefinite because they depend upon claim 1 which uses as its transitional phrase “consisting of” for the “nonwoven fabric” and, therefore, cannot add elements to the “nonwoven fabric.” Claims 12-15 and 24 add elements to the “nonwoven fabric.” (see MPEP 2111.03).

In claim 24, lines 1-2, the language “in accordance with claim 14” renders the claim indefinite because it is not clear by this language that the method is using the cover as claimed in claim 14.

***Claim Rejections - 35 USC §103***

The following is a quotation of 35 U.S.C. §103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 8, 12-15, and 18 are rejected under 35 U.S.C. §103(a) as being unpatentable over Matsunaga (JP 11-229260) in view of Harada et al. (JP402117322A).

As to Claim 1, Matsunaga disclose a protective cover ("plant protective sheet" of [Claim 1] of page 3 of translation) for protection of agricultural products, said cover sized to permit the cover to be positioned generally about an agricultural product (in that, sheet is positioned generally about a seed; from [0008] of page 9 of translation where "seat" is considered to be --- seed--), the cover being formed from a single ply of nonwoven fabric ([0012] of page 11 of translation) consisting of a spunbond ([0049] of page 27 of translation), thermoplastic polymeric filamentary elements ([0010] of page 10 of translation), the nonwoven fabric having a basis weight from 10 to 100 g/m sq. ([0011] of page 10 of translation). Not disclosed is the fabric having printing that occludes light transmission that alters ripening of the product prior to harvesting. Harada et al., however, discloses printing on a portion of the cover ("heat sensitive ink" of page 6, last para., of translation). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the cover of Matsunaga by adding heat sensitive ink as disclosed by Harada et al. so as to have a marker to detect temperature change when using the cover. The agricultural product would be grass (Matsunaga at [0003] of pages 6-7 of translation) and the harvesting would be mowing the grass.

As to Claim 8, Matsunaga as modified by Harada et al. further disclose a means for affixing the cover about an agricultural product ([0030] of page 20 of translation of Matsunaga).

As to Claim 12, Matsunaga as modified by Harada et al. further disclose pigments ([0023] of page 17 of translation of Matsunaga).

As to Claim 13, Matsunaga as modified by Harada et al. further disclose the additive as a melt additive ([0024] of page 17 of translation of Matsunaga).

As to Claims 14 and 15, Matsunaga as modified by Harada et al. further discloses a surface treatment and topically applied ([0030] of page 20 of translation of Matsunaga).

As to claim 18, Matsunaga discloses a method of protecting (from “plant protective sheet” of [Claim 1] of page 3 of translation) agricultural products, comprising the steps of providing at least one piece of nonwoven fabric ([0012] of page 11 of translation) consisting of a spunbond ([0049] of page 27 of translation), thermoplastic polymeric filamentary elements ([0010] of page 10 of translation); forming a sheet having a finite length and width (from “plant protective sheet” of [Claim 1] of page 3 of translation); and positioning the protective cover generally about an agricultural product to alter the ripening of the product prior to harvest (the agricultural product would be grass (Matsunaga at [0003] of pages 6-7 of translation) and the harvesting would be mowing the grass). Not disclosed is step of modifying the fabric by having printing that occludes light transmission that alters ripening of the product prior to harvesting. Harada et al., however, discloses printing on a portion of the cover (“heat sensitive ink” of page 6, last para., of translation). It would have been obvious to one of ordinary skill in the art at the time of the

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invention to modify the method of Matsunaga by adding heat sensitive ink as disclosed by Harada et al. so as to have a marker to detect temperature change when using the cover.

***Allowable Subject Matter***

Claims 16 and 23 are allowed over the art.

Claim 9 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 24 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

***Response to Arguments***

Applicant's arguments with respect to claims 1, 8,9, 12-15, and 24 have been considered but are moot in view of the new ground(s) of rejection.

***Conclusion***

Examiner draws the attention to Applicant that the word "seat" used throughout the translation of Matsunaga (JP11-229260) is considered a mistranslation of the word --seed--.

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Jeffrey L. Gellner whose phone number is 703.305.0053. The

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Examiner can normally be reached Monday through Thursday from 8:30 am to 4:00 pm. The Examiner can also be reached on alternate Fridays.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's Supervisor, Peter Poon, can be reached at 703.308.2574. The official fax telephone number for the Technology Center where this application or proceeding is assigned is 703.872.9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703.308.1113.

A handwritten signature in black ink, appearing to read 'J. L. Gellner', with a stylized flourish at the end.

Jeffrey L. Gellner  
Primary Examiner



**MACHINE-ASSISTED TRANSLATION (MAT):**

<b>(19)【発行国】</b> 日本国特許庁 ( J P )	<b>(19)[ISSUING COUNTRY]</b> Japan Patent Office (JP)
<b>(12)【公報種別】</b> 公開特許公報 ( A )	<b>(12)[GAZETTE CATEGORY]</b> Laid-open Kokai Patent (A)
<b>(11)【公開番号】</b> 特開平 11-229260	<b>(11)[KOKAI NUMBER]</b> Unexamined      Japanese      Patent      Heisei 11-229260
<b>(43)【公開日】</b> 平成 1 1 年 ( 1 9 9 9 ) 8 月 2 4 日	<b>(43)[DATE OF FIRST PUBLICATION]</b> August 24, Heisei 11 (1999. 8.24)
<b>(54)【発明の名称】</b> 生分解性防草シート	<b>(54)[TITLE OF THE INVENTION]</b> Biodegradable plant protection sheet
<b>(51)【国際特許分類第 6 版】</b> D04H    3/14 A01G 13/00      302 D01F    6/62      305	<b>(51)[IPC INT. CL. 6]</b> D04H    3/14 A01G 13/00      302 D01F    6/62      305
<b>【 F I 】</b> D04H    3/14              Z A01G 13/00      302 Z D01F    6/62      305 A	<b>[FI]</b> D04H    3/14              Z A01G 13/00      302 Z D01F    6/62      305 A
<b>【審査請求】</b> 未請求	<b>[REQUEST FOR EXAMINATION]</b> No
<b>【請求項の数】</b> 7	<b>[NUMBER OF CLAIMS]</b> 7
<b>【出願形態】</b> O L	<b>[FORM OF APPLICATION]</b> Electronic

**【全页数】 9****[NUMBER OF PAGES] 9****(21)【出願番号】**

特願平 10-35292

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February 18, Heisei 10 (1998. 2.18)

**(71)【出願人】****(71)[PATENTEE/ASSIGNEE]****【識別番号】**

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**[NAME OR APPELLATION]**

Morimoto Yoshihiro

**(57)【要約】****(57)[ABSTRACT OF THE DISCLOSURE]****【課題】**

遮光性が高く防草効果に優れ、適度な透水性を有し、しかも使用後はほぼ完全に生分解されるため廃棄処理が容易で自然環境を損なうことのない生分解性防草シートを提供する。

**[SUBJECT OF THE INVENTION]**

Light-shielding property is highly excellent in the plant-protection effect, and has moderate water permeability, and moreover, since biodegradation of after activity is carried out nearly completely, it is easy to waste-process and provides biodegradable plant protection sheet which does not impair natural environment.

**【解決手段】**

生分解性を有する熱可塑性脂肪族ポリエステル繊維からなる不織布にて形成する。前記ポリエステル繊維の単糸繊度を1～15デニールとする。前記防草シートは目付が50～300g/m<sup>2</sup>で、95%以上の遮光率を有し、かつ0.02～0.8cm/秒の透水係数を有するものとする。

**[PROBLEM TO BE SOLVED]**

It forms in nonwoven fabric which is made up of thermoplastic aliphatic polyester fiber which has biodegradability.

It makes single yarn size of said polyester fiber into 1 - 15 deniers.

Said plant protection sheet is fabric-weight 50-300 g /m<sup>2</sup>, and has 95 % or more shading rate, and it shall have coefficient of permeability of 0.02 to 0.8 cm/sec.

**【特許請求の範囲】****[CLAIMS]****【請求項1】**

生分解性を有する熱可塑性脂肪族ポリエステル繊維からなる不織布にて形成される防草シートであって、前記ポリエステル繊維の単糸繊度が1～15デニールで、前記防草シートは目付が50～300g/m<sup>2</sup>の範囲で、95%以上の遮光率を有し、

**[CLAIM 1]**

It is plant protection sheet formed in nonwoven fabric which is made up of thermoplastic aliphatic polyester fiber which has biodegradability, comprised such that with single yarn size of 1 - 15 deniers of said polyester fiber, said plant protection sheet is the range of fabric-weight 50-300 g /m<sup>2</sup>, has 95 % or more shading rate, and has coefficient of

かつ0.02～0.8 cm/秒の透水係数を有することを特徴とする生分解性防草シート。

permeability of 0.02 to 0.8 cm/sec.

Biodegradable plant protection sheet characterized by the above-mentioned.

**【請求項 2】**

熱可塑性脂肪族ポリエステルが、ポリ(D-乳酸)と、ポリ(L-乳酸)と、D-乳酸とL-乳酸との共重合体と、D-乳酸とヒドロキシカルボン酸との共重合体と、L-乳酸とヒドロキシカルボン酸との共重合体とから選ばれるいずれかの重合体、あるいはこれらのブレンド体であることを特徴とする請求項1記載の生分解性防草シート。

**[CLAIM 2]**

Thermoplastic aliphatic polyester are any of polymers chosen from these, or these blend bodies

Poly (D-lactic acid), poly (L-lactic acid), copolymer of D-lactic acid and L-lactic acid, copolymer of D-lactic acid and hydroxycarboxylic acid, and Copolymer of L-lactic acid and hydroxycarboxylic acid.

Biodegradable plant protection sheet of Claim 1 characterized by the above-mentioned.

**【請求項 3】**

熱可塑性脂肪族ポリエステルが、ポリブチレンサクシネート、ポリエチレンサクシネート、ポリブチレンアジペート、ポリブチレンセバケートから選ばれるいずれかの重合体、あるいはこれらの重合体要素を主繰り返し単位とした共重合体、あるいは前記重合体と共重合体とのうちの任意のもののブレンド体であることを特徴とする請求項1記載の生分解性防草シート。

**[CLAIM 3]**

Thermoplastic aliphatic polyester is polybutylene succinate, polyethylene succinate, polybutylene adipate, any of polymer chosen from polybutylene sebacate, copolymer which made these polymer components the main repeating units, or blend body of one as desired of said polymers and copolymers.

Biodegradable plant protection sheet of Claim 1 characterized by the above-mentioned.

**【請求項 4】**

熱可塑性脂肪族ポリエステルに結晶核剤が添加されていることを特徴とする請求項1から3

**[CLAIM 4]**

Nidus agent is added to thermoplastic aliphatic polyester.

Biodegradable plant protection sheet of any one

までのいずれか 1 項に記載の生分解性防草シート。 of Claim 1-3 characterized by the above-mentioned.

**【請求項 5】**

不織布を構成する繊維が原着繊維であることを特徴とする請求項 1 から 4 までのいずれか 1 項に記載の生分解性防草シート。

**[CLAIM 5]**

Fiber which comprises nonwoven fabric is original fiber.

Biodegradable plant protection sheet of any one of Claim 1-4 characterized by the above-mentioned.

**【請求項 6】**

不織布に生分解性を有する結合剤樹脂が含浸されて多孔性フィルム形状となっていることを特徴とする請求項 1 から 5 までのいずれか 1 項に記載の生分解性防草シート。

**[CLAIM 6]**

Binding-agent resin which has biodegradability in nonwoven fabric is impregnated, and it has become porous-film shape.

Biodegradable plant protection sheet of any one of Claim 1-5 characterized by the above-mentioned.

**【請求項 7】**

結合剤樹脂がけん化度 9.0 mol% 以上、重合度 500～2500 のポリビニルアルコールであり、不織布への付着量が 5～15 wt% であることを特徴とする請求項 6 記載の生分解性防草シート。

**[CLAIM 7]**

Binding-agent resin is polyvinyl alcohol of 90 mol% or more of saponification degree, and polymerization degree 500-2500.

Adhesion amount to nonwoven fabric is 5 to 15 wt%.

Biodegradable plant protection sheet of Claim 6 characterized by the above-mentioned.

**【発明の詳細な説明】****[DETAILED DESCRIPTION OF THE INVENTION]****【0001】****[0001]****【発明の属する技術分野】**

本発明は、使用後にはほぼ完全に分解されて廃棄処理が容易で

**[TECHNICAL FIELD OF THE INVENTION]**

It degrades used nearly completely and this invention relates to biodegradable plant

ある生分解性防草シートに関し、特に、高い遮光性と適度な透水性とを有し、しかも優れた防草効果を発揮するため農業分野や土木分野等において好適に使用できる生分解性防草シートに関する。

protection sheet with easy waste processing.

Specifically, it has high light-shielding property and moderate water permeability.

And in order to demonstrate the outstanding plant-protection effect, it is related with biodegradable plant protection sheet which can be conveniently used in agricultural field, public-works field, etc.

**【 0 0 0 2 】****[0002]****【従来の技術】**

近年、自然への回帰志向が高まる中で、公園、庭園、宅地などの緑化が盛んになっている。それに伴って植物栽培や美観維持のために、雑草の繁茂を防ぐための種々の努力が成されており、例えば、人手によって雑草を取り除いたり、除草剤を用いたり、わらを地面に敷き詰めて遮光したりすることにより、雑草の繁殖を抑えている。しかしいずれの方法も作業が煩雑で人件費がかかり、その防草効果も一時的なものであり、特に除草剤を用いた方法では、人体や植物に有毒であるという問題があった。

**[PRIOR ART]**

While regression intention to nature increases in recent years, greening of park, garden, housing site, etc. prospers.

Various efforts for preventing vegetation of weeds in connection with it for plant cultivation or fine sight maintenance have accomplished, for example, it removes weeds by manpower.

Moreover, it uses herbicide.

Moreover, it is restraining reproduction of weeds by laying over and shading straw on the ground. However, operation of any method is complicated, it requires labor cost, and these plant-protection effect is also temporary.

By method particularly using herbicide, problem of being poisonous existed in body or plant.

**【 0 0 0 3 】**

そのため、ビニールシートや、ゴム引きの織物シートや、ポリエステルやナイロンやポリプロピレン等からなる不織布などの遮光性の高いシートを、公園や

**[0003]**

Therefore, the method of laying over light-shieldable high seats, such as nonwoven fabric which is made up of plastic sheeting, rubberized textile seat, polyester, nylon, polypropylene, etc., on park, garden, or housing



庭園や宅地に敷き詰めて雑草の繁殖を抑える方法が提案されている。しかし、ビニールシートやゴム引きの織物シートは、シートに透水性が無いため、降雨などによる水がシート表面に溜まるという問題があった。また、防草シートを用いて植栽している場合に、植物に水を補給することが難しいという問題もあった。また、これらの遮光性シートは土壌表面や土壌中で分解されないため、植物が育った後あるいは植え替えの際にシートを取り外さなければならず、手間がかかり廃棄処理が煩雑であるという問題があった。さらに、これらの遮光性シートを堤防の法面などに用いた場合には、増水などにより遮光性シートが河川や海に流される可能性があるが、上述のように分解性を有していないため、河川や海に流れ出るとそのままの形状で浮遊し続けて自然環境を損なうという問題もあった。

【 0 0 0 4 】

【発明が解決しようとする課題】

本発明は、前記問題点を解決し、遮光性が高く防草効果に優れ、適度な透水性を有し、しかも使用後はほぼ完全に分解されるため廃棄処理が容易で自然環境を

site, and restraining reproduction of weeds is proposed.

However, in order that neither plastic sheeting nor rubberized textile seat might have water permeability in seat, there existed problem that seat surface was covered with water by rain fall etc.

Moreover, when planting using plant protection sheet, there also existed problem that it was difficult for plant to replenish water.

Moreover, there existed problem that they must remove seat when these light-shieldable seats are transplants after plant grows up or, and they required time and effort, and its waste processing was complicated since it does not degrade in soil surface or soil.

Furthermore, when these light-shieldable seats are used for face of slope of bank etc., light-shieldable seat may be poured by rise of water etc. in river or sea.

However, since it does not have degradability as mentioned above, if it flows into river or sea, continue floating in shape as it is, there also existed problem of impairing natural environment.

[0004]

[PROBLEM TO BE SOLVED BY THE INVENTION]

This invention solves said problem, light-shielding property is highly excellent in the plant-protection effect, it has moderate water permeability, and since it degrades nearly completely, after activity is easy to

損なうことのない生分解性防草シートを提供するものである。 waste-process and provides biodegradable plant protection sheet which does not impair natural environment.

**【0005】****[0005]****【課題を解決するための手段】****[MEANS TO SOLVE THE PROBLEM]**

本発明者らは、上記問題点を解決するために鋭意検討をした結果、本発明に到達したものである。すなわち本発明は、生分解性を有する熱可塑性脂肪族ポリエステル繊維からなる不織布にて形成される防草シートであつて、前記ポリエステル繊維の単糸繊維度が1～15デニールで、前記防草シートは目付が50～300g/m<sup>2</sup>の範囲で、95%以上の遮光率を有し、かつ0.02～0.8cm/秒の透水係数を有することを特徴とする生分解性防草シートを要旨とするものである。

Present inventors did earnest examination, in order to solve the above-mentioned problem. As a result, it attained this invention.

That is, this invention is a plant protection sheet formed in nonwoven fabric which is made up of thermoplastic aliphatic polyester fiber which has biodegradability, comprised such that with single yarn size of 1 - 15 deniers of said polyester fiber, said plant protection sheet is the range of fabric-weight 50-300 g /m<sup>2</sup>, and has 95 % or more shading rate, and it has coefficient of permeability of 0.02 to 0.8 cm/sec. It makes into summary biodegradable plant protection sheet characterized by the above-mentioned.

**【0006】****[0006]**

このように本発明によれば、生分解性を有する熱可塑性脂肪族ポリエステル繊維からなる不織布にて防草シートを形成することで、一定期間が経過した後のシートは生分解によりほぼ完全に分解されるため、シートを取り外して廃棄処理を行う手間が省け、しかも自然環境を汚染することがないという利点がある。

Thus, since seat after fixed period elapses by forming plant protection sheet in nonwoven fabric which is made up of thermoplastic aliphatic polyester fiber which has biodegradability is disassembled nearly completely by biodegradation according to this invention, it can save time and effort which removes seat and performs waste processing, and there exists advantage of moreover not contaminating natural environment.



**【0007】**

また、ポリエステル繊維の単糸繊維度を1～15デニール、前記防草シートの目付を50～300 g/m<sup>2</sup>の範囲で調整することによりシートが生分解する際の分解速度を制御することができる。また、ポリエステル繊維の単糸繊維度および不織布の目付を上記範囲で調整して、結果的に遮光率を95%以上とすることで、雑草の繁殖を抑え十分な防草効果を得ることができる。

**[0007]**

Moreover, decomposition rate at the time of seat carrying out biodegradation of the single yarn size of polyester fiber by adjusting fabric weight of 1 - 15 deniers and said plant protection sheet in the range of 50-300 g/m<sup>2</sup> is controllable.

Moreover, it adjusts single yarn size of polyester fiber, and fabric weight of nonwoven fabric in the above-mentioned range, by consequently making shading rate into 95 % or more, it can restrain reproduction of weeds and can acquire sufficient plant-protection effect.

**【0008】**

さらに、防草シートの透水係数を0.02～0.8 cm/秒の範囲とすることで、降雨などによる水がシート表面に溜まることなく、また、防草シートを用いて植栽している場合には、植物に十分な水を補給することができ、さらに液肥の散布も可能になる。

**[0008]**

Furthermore, when seat surface is not covered with water by rain fall etc. and it is planting using plant protection sheet by making coefficient of permeability of plant protection sheet into the range of 0.02 to 0.8 cm/sec, it can replenish sufficient water for plant.

Furthermore, it comes to be also able to carry out spraying of liquid fertilizer.

**【0009】****【発明の実施の形態】**

本発明における生分解性防草シートは、生分解性を有する熱可塑性脂肪族ポリエステル繊維からなる不織布により形成される必要がある。このような生分解性の繊維を用いることで、一定期間が経過した後のシートは微

**[0009]****[EMBODIMENT OF THE INVENTION]**

Biodegradable plant protection sheet in this invention needs to be formed of nonwoven fabric which is made up of thermoplastic aliphatic polyester fiber which has biodegradability.

Since microorganisms degrade nearly completely, seat after fixed period elapses can



生物によりほぼ完全に分解されるため、シートを取り外して廃棄処理を行う手間が省け、しかも自然環境を汚染することがない。

save time and effort which removes seat and performs waste processing, and, moreover, does not contaminate natural environment with using such biodegradable fiber.

#### 【0010】

熱可塑性脂肪族ポリエステル繊維の単糸繊度は、1～15デニールである必要がある。単糸繊度が1デニール未満であると、製糸工程において操業性を損い、また防草シートとした際の分解速度が速すぎて防草効果が一時的なものとなる。単糸繊度が15デニールを越えると、紡出糸条の冷却性に劣り、また得られる不織布の柔軟性を損なうため防草シートとして使用する際の作業性に支障を来すことになる。そのため、好ましくは単糸繊度が2～10デニール、さらに好ましくは3～7デニールであるポリエステル繊維を用いることが望ましい。

#### [0010]

Single yarn size of thermoplastic aliphatic polyester fiber needs to be 1 - 15 deniers.

Decomposition rate at the time of spoiling operation property in spinning process as single yarn size is less than 1 denier, and considering it as plant protection sheet is too quick, and the plant-protection effect will become temporary.

If single yarn size exceeds 15 deniers, in order are inferior to the cooling property of spun thread and to impair the flexibility of nonwoven fabric obtained, it will interfere with operativity at the time of using it as a plant protection sheet.

Therefore, it is desirable that single yarn size of 2 - 10 deniers preferably uses polyester fiber which is 3 - 7 deniers furthermore preferably.

#### 【0011】

防草シートの目付は50～300 g/m<sup>2</sup>の範囲である必要がある。目付が50 g/m<sup>2</sup>未満であると、遮光性に劣り十分な防草効果が得られず実用性に乏しいものとなり、目付が300 g/m<sup>2</sup>を越えると、シートが生分解する際の分解速度が遅くなりすぎ、またシートの製造コ

#### [0011]

Fabric weight of plant protection sheet needs to be the range of 50-300 g /m<sup>2</sup>.

If it is inferior light-shieldable in fabric weight being under 50 g /m<sup>2</sup>, and sufficient plant-protection effect is not acquired, but it becomes thing lacking in practicability and fabric weight exceeds 300 g /m<sup>2</sup>, decomposition rate at the time of seat carrying out biodegradation will become slow too much,



ストが高くなる。

and manufacturing cost of seat will become higher.

【0012】

上記のような単糸繊度のポリエステル繊維にて形成され、上記の範囲の目付を有する不織布にて構成された防草シートは、95%以上の遮光率を有する必要がある。遮光性が95%より小さくなると、十分な防草効果が得られなくなる。

[0012]

Plant protection sheet which comprised nonwoven fabrics which are formed in polyester fiber of the above single yarn sizes, and have fabric weight of the above-mentioned range needs to have 95 % or more shading rate.

If light-shielding property becomes smaller from 95%, sufficient plant-protection effect will no longer be acquired.

【0013】

すなわち本発明においては、ポリエステル繊維の単糸繊度を1～15デニール、防草シートの目付を50～300 g/m<sup>2</sup>の範囲でそれぞれ調整することにより遮光率を95%以上とすることができ、雑草の繁殖を抑え十分な防草効果を得ることができる。また、ポリエステル繊維の単糸繊度および防草シートの目付を上記範囲で調整することで、遮光率だけでなくシートが生分解する際の分解速度も制御することができる。

[0013]

That is, in this invention, by each adjusting fabric weight of 1 - 15 deniers, and plant protection sheet for single yarn size of polyester fiber in the range of 50-300 g /m<sup>2</sup>, it can make shading rate into 95 % or more, can restrain reproduction of weeds, and can acquire sufficient plant-protection effect.

Moreover, not only shading rate but decomposition rate at the time of seat carrying out biodegradation is controllable by adjusting single yarn size of polyester fiber, and fabric weight of plant protection sheet in the above-mentioned range.

【0014】

なお、ポリエステル繊維の単糸繊度と防草シートの目付とは密接な関係にあり、例えば、単糸繊度が細い場合には同一目付でも緻密なシートとなるが、生分解に伴う機械的強力の低下が速

[0014]

In addition, single yarn size of polyester fiber and fabric weight of plant protection sheet have close relation.

For example, when single yarn size is slender, the same fabric weight also constitutes precise seat.

いため十分な防草効果が得られなくなる。また、繊維自体の機械的強度が低い場合には、シートとしての一定強度を得るために、単糸繊度および目付を大きくすることが必要である。また、上記の目付の防草シートは一工程で得られたものであっても良いし、2枚以上の不織布を積層して得たものであっても良い。

However, since mechanical powerful decline accompanying biodegradation is quick, sufficient plant-protection effect is no longer acquired.

Moreover, when mechanical strength of fiber itself is low, in order to obtain fixed strength as a seat, it is necessary to enlarge single yarn size and fabric weight.

Moreover, one was obtained by it having been obtained in one process and laminating nonwoven fabric of two or more sheets is sufficient as plant protection sheet of the above-mentioned fabric weight.

#### 【0015】

また、防草シートの透水係数は、JIS-A-1218に準じて測定した透水係数が0.02～0.8 cm/秒の範囲である必要がある。透水係数が0.02 cm/秒未満であると、透水性が低いため降雨などによる水がシート表面に溜まり、栽培している植物に十分な水を供給できなくなる。透水係数が0.8 cm/秒を越えると、透水性は良好であるが、構成繊維間の空隙部分が多いため、遮光性に劣るものとなる。このような透水係数を有する防草シートとすることで、降雨などによる水がシート表面に溜まらないようになり、また、防草シートを用いて植栽している場合でも植物に十分な水を補給することができ、さらに液肥の散布も可能とな

#### [0015]

Moreover, coefficient of permeability of plant protection sheet needs to be the range of 0.02 to 0.8 cm/sec coefficient of permeability measured according to JIS-A-1218.

It becomes impossible for water according that coefficient of permeability is less than 0.02 cm/sec to rain fall etc. since water permeability is low to supply sufficient water for pool and plant which it is growing to seat surface.

Water permeability is good if coefficient of permeability exceeds 0.8 cm/sec.

However, since there are many gaps of configuration interfiber, it is inferior light-shieldable.

Seat surface ceases to be covered with water by rain fall etc. by considering it as plant protection sheet which has such a coefficient of permeability, moreover, even when planting using plant protection sheet, it can replenish sufficient water for plant.

Furthermore, it can also carry out spraying of

る。

liquid fertilizer.

**【0016】**

生分解性を有する熱可塑性脂肪族ポリエステルとしては、例えば、ポリグリコール酸やポリ乳酸のようなポリ ( $\alpha$ -ヒドロキシ酸) またはこれらの重合体要素を主たる繰り返し単位とする共重合体が挙げられる。また、ポリ ( $\epsilon$ -カプロラクトン)、ポリ ( $\beta$ -プロピオラクトン) のようなポリ ( $\omega$ -ヒドロシアルカノエート) が、さらに、ポリ-3-ヒドロキシプロピオネート、ポリ-3-ヒドロキシブチレート、ポリ-3-ヒドロキシカプロレート、ポリ-3-ヒドロキシヘプタノエート、ポリ-3-ヒドロキシオクタノエートのようなポリ ( $\beta$ -ヒドロシアルカノエート) およびこれらを構成する繰り返し単位とポリ-3-ヒドロキシバリレートやポリ-4-ヒドロキシブチレートを構成する繰り返し単位との共重合体が挙げられる。また、グリコールとジカルボン酸の縮重合体から成るポリアルキレンアルカノエートとしては、例えば、ポリエチレンオキサレート、ポリエチレンサクシネート、ポリエチレンアジペート、ポリエチレンアゼレート、ポリブチレンオキサレート、ポリブチレンサクシネート、ポリブチレンア

**[0016]**

As thermoplastic aliphatic polyester which has biodegradability, copolymer like polyglycolic acid or poly lactic acid which makes poly ((alpha)- hydroxy acid) or these polymer components the main repeating units is mentioned, for example.

Moreover, poly (omega) - hydroxy alkanoates like Poly ((epsilon)-caprolactone) and Poly ((beta)- propio lactone)

Furthermore, poly ((beta)- hydroxy alkanoates) like poly- 3-hydroxy propionate, poly- 3-hydroxybutyrate, Poly- 3-hydroxy caproate, poly- 3-hydroxy heptanoate, and Poly- 3-hydroxy octanoate

And copolymer of repeating unit which comprises these, and repeating unit which comprises poly- 3-hydroxyvalerate and poly- 4-hydroxybutyrate is mentioned.

Moreover, as a polyalkylene alkanoate which constitutes of condensation polymer of glycol and dicarboxylic acid, polyalkylene alkanoate copolymer which makes polyethylene oxalate, polyethylene succinate, polyethylene adipate, polyethylene azelate, polybutylene oxalate, polybutylene succinate, polybutylene adipate, polybutylene sebacate, polyhexamethylene sebacate, poly neopentyl oxalates, or these polymer components the main repeating units is mentioned, for example.

Furthermore, it can make multiple-kinds option of the polymer which each has biodegradability like these, and can also apply one blended these.

ジペート、ポリブチレンセバケート、ポリヘキサメチレンセバケート、ポリネオペンチルオキサレートまたはこれらの重合体要素を主たる繰り返し単位とするポリアルキレンアルカノエート共重合体が挙げられる。さらに、これらのような個々に生分解性を有する重合体を複数種選択し、これらをブレンドしたものを適用することもできる。

**【0017】**

本発明においては、生分解および製糸性の点から、上記の中でも特に、ポリ乳酸系重合体あるいは、ポリアルキレンアルカノエートまたはこれらの重合体要素を主たる繰り返し単位とした共重合体、またはこれらのブレンド体である熱可塑性脂肪族ポリエステルが好適に使用できる。

**【0018】**

ポリ乳酸系重合体としては、ポリ(D-乳酸)と、ポリ(L-乳酸)と、D-乳酸とL-乳酸との共重合体と、D-乳酸とヒドロキシカルボン酸との共重合体と、L-乳酸とヒドロキシカルボン酸との共重合体とから選ばれ得るいずれかの重合体、あるいはこれらのブレンド体である熱可塑性脂肪族ポリエステルにて形成されることが好ましい。

**[0017]**

Particularly in this invention, thermoplastic aliphatic polyester which is copolymers which made poly-lactic-acid type polymer, polyalkylene alkanoates, or these polymer components the main repeating units among the above, or these blend bodies can use it conveniently from point of biodegradability and spinning property.

**[0018]**

As a poly-lactic-acid type polymer, being poly (D-lactic acid) and being poly (L-lactic acid) and thing formed with thermoplastic aliphatic polyester which is any of polymers chosen from copolymer of D-lactic acid and L-lactic acid, copolymer of D-lactic acid and hydroxycarboxylic acid, and copolymer of L-lactic acid and hydroxycarboxylic acid or these blend bodies are desirable.

Polymer whose melting point is 80 degrees C or more particularly can use it conveniently.

中でも特に、融点が80℃以上である重合体が好適に使用できる。ここで、乳酸とヒドロキシカルボン酸との共重合体である場合におけるヒドロキシカルボン酸としては、グリコール酸、ヒドロキシ酪酸、ヒドロキシ吉草酸、ヒドロキシカプロン酸、ヒドロキシヘプタン酸、ヒドロキシカプリル酸などが挙げられる。

#### 【0019】

ポリアルキレンアルカノエートとしては、ポリブチレンサクシネート、ポリエチレンサクシネート、ポリブチレンアジペート、ポリブチレンセバケートから選ばれるいずれかの重合体、あるいはこれらの重合体要素を主繰り返し単位とした共重合体、あるいは前記重合体と共重合体のうちの任意のもののブレンド体であることが好ましく、具体的には、70モル%以上のブチレンサクシネートと、エチレンサクシネートまたはブチレンアジペートまたはブチレンセバケートのいずれかとから成る共重合体が好ましい。ただし、ポリブチレンサクシネート単体で使用する最には、ポリブチレンサクシネートは分解速度が速いため、後述のようにポリブチレンサクシネートからなる不織布は結合剤樹脂の含浸により多孔性

Here, as hydroxycarboxylic acid in case of being copolymer of lactic acid and hydroxycarboxylic acid, glycolic acid, hydroxybutyric acid, hydroxy valeric acid, hydroxy caproic acid, hydroxy heptanoic acid, hydroxy caprylic acid, etc. are mentioned.

#### [0019]

It is desirable that they are polybutylene succinate, polyethylene succinate, polybutylene adipate, any of polymer chosen from polybutylene sebacate, copolymer which made these polymer components the main repeating units, or blend body of one as desired of said polymers and copolymers as a polyalkylene alkanoate, specifically, either of 70 mol% or more butylene succinate, or ethylene succinate, butylene adipate or butylene sebacate

Copolymer which constitutes of these is desirable.

However, when using it with polybutylene succinate single separate item, since polybutylene succinate has quick decomposition rate, it is necessary for nonwoven fabric which is made up of polybutylene succinate like after-mentioned to constitute porous film shape by impregnation of binding-agent resin.

のフィルム形状となっていることが必要となる。

**【0020】**

なお、上記の熱可塑性脂肪族ポリエステルは、数平均分子量が約20,000以上、好ましくは40,000以上のものが製糸性及び得られる糸条特性の点から好適に使用できる。また、重合度を高めるために少量のジイソシアネートやテトラカルボン酸二無水物などで鎖延長したものである。

**【0021】**

また、熱可塑性脂肪族ポリエステルには、結晶核剤が添加されていてもよい。結晶核剤としては、タルク、窒化ホウ素、炭酸カルシウム、炭酸マグネシウム、酸化チタンなどが挙げられる。このような結晶核剤を添加すると、熱可塑性脂肪族ポリエステルの結晶化が促進されて、防草シートとした際の耐熱性や機械的強度が向上することとなる。また、熱可塑性脂肪族ポリエステルの紡糸する際には、紡出・冷却工程における糸条間の融着（ブロッキング）を防止できる。

**【0022】**

上記の理由により構成繊維の結晶化度が10～40%の範囲にあることが好ましい。この範囲

**[0020]**

In addition, preferably number average molecular weight can use the above-mentioned thermoplastic aliphatic polyester about 20,000 or more conveniently [ 40,000 or more one ] from point of spinning property and thread line property acquired.

Moreover, in order to raise polymerization degree, one carried out strand extension by a little diisocyanate, tetracarboxylic-acid dianhydride, etc. is also possible.

**[0021]**

Moreover, nidus agent may be added to thermoplastic aliphatic polyester.

As a nidus agent, talc, boron nitride, calcium carbonate, magnesium carbonate, titanium oxide, etc. are mentioned.

Adding of such a nidus agent promotes crystallization of thermoplastic aliphatic polyester, heat resistance at the time of considering it as plant protection sheet and mechanical strength will improve.

Moreover, when carrying out fiber formation of the thermoplastic aliphatic polyester, it can prevent fusion between thread lines in spin-out / cooling process (blocking).

**[0022]**

It is desirable that degree of crystallinity of configuration fiber exists in range which is 10 to 40% for the above-mentioned reason.



の結晶化度を達成するためには、熱可塑性脂肪族ポリエステルに対する結晶核剤の添加量は、0.1～3.0重量%の範囲、より好ましくは0.5～2.0重量%の範囲であることが望ましい。

**【0023】**

また、上記結晶核剤だけでなく、顔料、艶消し剤、着色剤、難燃剤などの各種添加剤を、本発明の効果を損なわない範囲で、必要に応じて添加しても良い。例えば、カーボンブラックや黒色染料などを添加すると、シートの色が黒色となり防草シートが熱を吸収しやすくなるため、防草シートを用いて植栽している場合などには保温効果が得られ、植物の成育に寄与することができる。ただし、あまり添加剤の添加量を多くすると、繊維を紡出する際に製糸性が低下することから、添加剤は熱可塑性脂肪族ポリエステルに対し0.1～3.0重量%、好ましくは0.5～2.0重量%の範囲で用いることが肝要である。

**【0024】**

上記のような熱可塑性脂肪族ポリエステルからなる繊維は、顔料などをあらかじめ練り込んだポリマーを紡糸した繊維である原着繊維であることが好まし

In order to attain degree of crystallinity of this range, additional amount of nidus agent with respect to thermoplastic aliphatic polyester is 0.1 to 3.0weight% of range, it is desirable that it is 0.5 to 2.0weight% of range more preferably.

**[0023]**

Moreover, it may add various additive agents, such as not only the above-mentioned nidus agent but pigment, grinding agent, tinction, fire resistance agent, etc., as required in the range which does not impair effect of this invention.

For example, since color of seat will become black and plant protection sheet will become easy to absorb heat if carbon black, black stain, etc. are added, when planting using plant protection sheet, the heat retention effect is acquired, it can contribute to growth of plant.

However, additive agent since spinning property will fall when spinning out fiber if additional amount of additive agent is increased excessively is 0.1 to 3.0 weight% to thermoplastic aliphatic polyester, it is important to use in 0.5 to 2.0weight% of the range preferably.

**[0024]**

As for fiber which is made up of the above thermoplastic aliphatic polyester, it is desirable that it is original fiber which is fiber which carried out fiber formation of the polymer which scoured pigment etc. beforehand.

い。このような原着繊維を用いると、繊維に予め顔料が含まれているため後加工による染色が不要になり、染色による熱劣化がなくなり、また工程数も減るため低コスト化が図れる。さらに、繊維化した後の染色では着色しにくい熱可塑性脂肪族ポリエステル繊維についても、良好な染色が得られる。

**【0025】**

熱可塑性脂肪族ポリエステルからなる繊維の繊維形態は、特に限定されるものではなく、脂肪族ポリエステルを単独で用いたものでも良いし、2種以上の脂肪族ポリエステルを用いた複合繊維でも良い。また、繊維横断面は、通常の丸断面の他にも、中空断面、異形断面、並列型複合断面、多層型複合断面、芯鞘型複合断面、分割型複合断面など、その目的と用途に応じて任意の繊維横断面形態を採用することができる。特に生分解性能の点からは、中空断面、異形断面、分割型複合断面を有する繊維が好適に使用できる。

**【0026】**

この繊維横断面のほかに、熱可塑性脂肪族ポリエステルの種類や共重合比、脂肪族ポリエステ

If such original fiber is used, since dyeing by post processing becomes unnecessary since pigment is beforehand contained in fiber, thermal deterioration by dyeing is lost and the number of processes also becomes fewer, it can attain cost reduction.

Furthermore, in dyeing after fibrosing, good dyeing is obtained also about thermoplastic aliphatic polyester fiber which is hard to color.

**[0025]**

Fiber form in particular of fiber which is made up of thermoplastic aliphatic polyester is not limited, and one using aliphatic polyester independently is also possible for it.

Composite fiber using 2 or more types of aliphatic polyester are also possible.

Moreover, according to these objective and applications, such as hollow cross section, unusual shape cross section, parallel connected type composite cross section, multiple-layers type composite cross section, core-sheath type composite cross section, and split-type composite cross section, fiber cross-section form as desired other than usual circle cross section can be used for fiber cross section.

Particularly from point of biodegradable ability, fiber which has hollow cross section, unusual shape cross section, and split-type composite cross section can use it conveniently.

**[0026]**

By choosing suitably class of thermoplastic aliphatic polyester, copolymerization ratio, blend ratio of aliphatic polyester, etc. other than this

ルのブレンド比などを適宜選択することによって、防草シートとした際の生分解速度を制御することができ、使用目的に応じた生分解速度を有する防草シートとすることができる。

#### 【0027】

熱可塑性脂肪族ポリエステル繊維からなる不織布は、短繊維または長繊維のいずれの繊維から構成されていても良いが、最良のコストパフォーマンスを考慮すると長繊維不織布をベースにしたものが好ましい。

#### 【0028】

不織布の引張強力は、目付100 g/m<sup>2</sup>に換算したときの引張強力が5 kg/5 cm幅以上であることが好ましく、さらに好ましくは10 kg/5 cm幅以上である。引張強力が5 kg/5 cm幅未満であると、土壌表面にシートを敷設する際に作業性が悪くなり好ましくない。なお、不織布の引張強力は、不織布を構成する繊維に用いた重合体の種類や、構成繊維の繊度や強度、また不織布の目付および後述の不織布の部分熱圧着条件などによって決まる。

#### 【0029】

また、本発明の防草シートを構

fiber cross section, it can control biodegradation speed at the time of considering it as plant protection sheet, and can consider it as plant protection sheet which has biodegradation speed according to purpose of use.

#### [0027]

Nonwoven fabric which is made up of thermoplastic aliphatic polyester fiber may comprise which fiber of short fiber or long fiber. However, when best cost performance is considered, one used long-fiber nonwoven fabric as base is desirable.

#### [0028]

Furthermore preferably it is more than 10kg / 5-cm width preferably that tensile strength when converting tensile strength of nonwoven fabric into fabric-weight 100 g /m<sup>2</sup> is more than 5kg / 5-cm width.

Operativity worsens and is not desirable, when laying seat on soil surface as tensile strength is under 5kg / 5-cm width.

In addition, tensile strength of nonwoven fabric is decided by partial thermocompression-bonding conditions of size and strength of class of polymer used for fiber which comprises nonwoven fabric, and configuration fiber, fabric weight of nonwoven fabric, and the below-mentioned nonwoven fabric etc.

#### [0029]

Moreover, as for nonwoven fabric which

成する不織布は、ウェブが部分的に熱圧着されて不織布としての形態が保持されていることが好ましい。部分的に熱圧着された不織布は、点状融着区域においてのみ接着されているため、柔軟性と形態保持性とを兼備するものとなり、防草シートとした際の作業性が向上する。ここで、部分的な熱圧着とは、エンボス加工または超音波融着処理によって点状融着区域を形成するものをいい、具体的には、加熱されたエンボスロールと表面が平滑な金属ロールとの間にウェブを通して繊維間に点状融着区域を形成する方法またはパターンロール上で超音波による高周波を印加してパターン部の繊維間に点状融着区域を形成する方法が採用される。

**【0030】**

熱可塑性脂肪族ポリエステル繊維からなる不織布は、生分解性を有する結合剤樹脂の含浸により多孔性フィルム形状となってもよい。具体的には、ポリビニルアルコール、澱粉、膠といった生分解性を有する結合剤樹脂を用いて、その結合剤樹脂の溶液や分散液に不織布を浸漬させて液を含浸させ、その後乾燥させることにより多孔性フィルム形状の生分解性防草シート

comprises plant protection sheet of this invention, it is desirable that thermocompression bonding of the web is carried out partially, and form as a nonwoven fabric is maintained.

Since it has attached only in punctiform fusion area, nonwoven fabric by which thermocompression bonding was carried out partially becomes one combines flexibility and form retention, and operativity at the time of considering it as plant protection sheet improves it.

The method of partial thermocompression bonding meaning one forms punctiform fusion area by embossing or ultrasonic fusion treatment, impressing high frequency wave by ultrasonic wave on the method of forming punctiform fusion area in interfiber through web or pattern roll between embossing roll heated specifically and metal roll with flat and smooth surface, and forming punctiform fusion area here at interfiber of pattern part is adopted.

**[0030]**

Nonwoven fabric which is made up of thermoplastic aliphatic polyester fiber may constitute porous-film shape by impregnation of binding-agent resin which has biodegradability. Specifically, using binding-agent resin which has biodegradability, such as polyvinyl alcohol, starch, and glia, it lets solution and dispersion of these binding-agent resin immerse nonwoven fabric, and impregnates liquid. It can consider it as biodegradable plant protection sheet of porous-film shape by after that making it dry.



とすることができる。このように不織布に結合剤樹脂を含浸させることにより、生分解速度の速い繊維を用いた場合でもシートが生分解速度を遅くすることができ、また、シートに耐候性を付与することもできる。

**【0031】**

結合剤樹脂としては、けん化度が90mol%以上で、重合度が500～2500のポリビニルアルコールが好適に使用できる。けん化度が90mol%未満であると結晶性が低くなり、雨水などによって結合剤樹脂が流れ出てしまうため好ましくない。また、重合度が500未満であると水溶液の粘度が低下してしまい、重合度が2500を越えると水溶液粘度が高すぎるため、いずれの場合も結合剤樹脂を不織布に含浸させるにくくなる。

**【0032】**

また、結合剤樹脂の不織布への付着量は、5～15wt%であることが好ましい。不織布への結合剤樹脂の付着量が5wt%未満であると、生分解性を制御する効果が不十分となり、結合剤樹脂の付着量が5wt%を越えるとポリビニルアルコールがフィルム状になり透水性を損なうこととなる。

Thus, by letting nonwoven fabric impregnate binding-agent resin, even when fiber with quick biodegradation speed is used, it can make biodegradation speed of seat late, and it can also provide weather resistance on seat.

**[0031]**

As binding-agent resin, saponification degree is 90 mol% or more, and polyvinyl alcohol of polymerization degree 500-2500 can use it conveniently.

Since crystallinity becomes it low that saponification degree is less than 90 mol% and binding-agent resin flows out with storm sewage etc., it is not desirable.

Viscosity of aqueous solution falls that polymerization degree is less than 500, and also when it is any, it stops moreover, letting nonwoven fabric impregnate binding-agent resin, since aqueous solution viscosity is too high when polymerization degree exceeds 2500.

**[0032]**

Moreover, as for adhesion amount to nonwoven fabric of binding-agent resin, it is desirable that it is 5 to 15 wt%.

When effect which controls biodegradability as adhesion amount of binding-agent resin to nonwoven fabric is 5 wt% less becomes inadequate and adhesion amount of binding-agent resin exceeds 5 wt%, polyvinyl alcohol becomes film-like and will impair water permeability.

**【 0 0 3 3 】**

以下に本発明の防草シートの製造方法を長繊維不織布からなるものを代表例として説明する。まず、本発明の防草シートを構成するための長繊維不織布は、いわゆるスパンボンド法にて効率よく製造することができる。すなわち、上述の熱可塑性脂肪族ポリエステルを加熱溶解して紡糸口金から吐出させ、得られた紡出糸条を従来公知の横型吹付や環状吹付などの冷却装置を用いて冷却し、その後、エアーサuckerなどの吸引装置にて牽引細化する。引き続き、吸引装置から排出された糸条群を開繊させた後、スクリーンから成るコンベアの如き移動堆積装置上に堆積させてウェブとする。次いで、この移動堆積装置上に形成されたウェブに、加熱されたエンボスロールまたは超音波融着装置などの部分熱圧着装置を用いて、部分的に熱圧着を施すことにより長繊維不織布を得る。

**【 0 0 3 4 】**

本発明において長繊維不織布を適用する場合、紡出糸条を1000～6000 m/分の高速で牽引細化することが好ましい。

**[0033]**

It demonstrates one becomes below from long-fiber nonwoven fabric about manufacturing method of plant protection sheet of this invention as a representative example.

First, it can manufacture efficiently long-fiber nonwoven fabric for comprising plant protection sheet of this invention by the so-called spun bonding method.

That is, it heat-melts the above-mentioned thermoplastic aliphatic polyester, and makes it send out from spinneret.

It cools obtained spun thread using cooling devices, such as conventionally well-known horizontal-type spraying and annular spraying, and, after that, carries out pull refinement with suction apparatus, such as air sucker.

Then, after opening fiber thread line group discharged from suction apparatus, it makes it deposit on migration deposition apparatus like conveyor which constitutes of screen, and considers it as web.

Subsequently, it obtains long-fiber nonwoven fabric by giving thermocompression bonding partially to web formed on this migration deposition apparatus using partial thermo-compression bonding apparatuses, such as heated embossing roll or ultrasonic fusion apparatus.

**[0034]**

When applying long-fiber nonwoven fabric in this invention, it is desirable to carry out pull refinement of the spun thread at high speed of 1000 to 6000 m/min.

紡出糸条を牽引細化する際に牽引速度が1000 m/分未満では、重合体の配向結晶化が進まず、得られる不織布の機械的強度が低下したり生分解速度が過度に促進されることとなり、逆に、牽引速度が6000 m/分を越えると、製糸性が急激に悪化して糸切れを起こすため、好ましくない。

**【0035】**

なお、上記説明では長繊維不織布について述べたが、本発明はこれに限定されるものではなく、短繊維不織布についても同様に、従来公知の方法にて短繊維を作成し、これを用いて不織布とすることにより防草シートを作成することができる。

**【0036】****【実施例】**

次に、実施例に基づき本発明を具体的に説明するが、本発明はこれらの実施例のみに限定されるものではない。なお、以下の実施例、比較例における各種物性値の測定は以下の方法により実施した。

**【0037】**

(1) 融点 (°C) : パーキンエルマー社製の示差走査熱量計DS

It is not desirable, in order that spinning property may aggravate rapidly and may cause thread breakage, if drawing velocity is less than 1000 m/min when carrying out pull refinement of the spun thread, orientation crystallization of polymer will not progress, mechanical strength of nonwoven fabric obtained will decline, or biodegradation speed will be promoted too much and drawing velocity exceeds 6000 m/min conversely.

**[0035]**

In addition, the above-mentioned explanation described long-fiber nonwoven fabric.

However, this invention is not limited to this, can make short fiber by the conventionally well-known method similarly about short-fiber nonwoven fabric, and can make plant protection sheet by considering it as nonwoven fabric using this.

**[0036]****[EXAMPLES]**

Next, based on Example, it specifically demonstrates this invention.

This invention is not limited only to these Examples.

In addition, it implemented measurement of various physical-property values in the following Examples and Comparative Example with following method.

**[0037]**

(1) Melting point (degree C) : it made temperature which measures temperature



C-7型を用いて、昇温速度を20℃/分で測定し、得られた融解吸熱曲線において極値を与える温度を融点とした。

increase rate by 20 degree-C/min, and gives extreme value in obtained fusion heat-absorption curve into melting point using differential-scanning-calorimeter DSC-7 type made from Perkin-Elmer corporation.

## 【0038】

(2) メルトフローレート (g/10分): ASTM-D1238 (L) に記載の方法に準じて測定した。

## [0038]

(2) Melt flow rate (g/10min.): according to the method of publication, it measured to ASTM-D1238(L).

## 【0039】

(3) ポリエチレンテレフタレートの固有粘度: フェノールと四塩化エタンの等重量混合溶液を溶媒とし、試料濃度0.5 g/dl、温度20℃で測定した。

## [0039]

(3) Intrinsic viscosity of polyethylene terephthalate: it used phenol and equivalent-weight mixed solution of ethane tetrachloride as solvent, and measured at sample concentration of 0.5 g/dl, and temperature of 20 degrees C.

## 【0040】

(4) 繊度 (デニール): ウェブの状態における繊維径を50本顕微鏡にて測定し、密度補正して求めた繊度の平均値を繊度 (デニール) とした。

## [0040]

(4) Size (denier): it made into size (denier) average value of size which measured and carried out density correction of the fiber diameter in state of web, and required for it under 50 microscopes.

## 【0041】

(5) 目付 (g/m<sup>2</sup>): 標準状態の試料から縦10cm×横10cmの試料各10点を作製し、平衡水分に至らしめた後、各試料片の重量 (g) を秤量し、得られた値の平均値を単位面積あたりに換算し、目付 (g/m<sup>2</sup>) とした。

## [0041]

(5) Fabric weight (g/m<sup>2</sup>): after producing each ten samples of longitudinal 10cm \* transversal 10cm from sample of standard condition and making it lead in equilibrium moisture, it measured weight (g) of each sample piece, converted average value of acquired value into per unit area, and considered it as fabric weight (g/m<sup>2</sup>).





## 【0042】

(6) 引張強力 (kg / 5 cm 幅) : JIS-L1906に記載のストリップ法に準じて測定した。すなわち、試料長が20 cm、試料幅が5 cmの試料片を不織布の縦方向 (MD) 及び横方向 (CD) にそれぞれ10点作成し、各試料片ごとに、不織布のMD方向およびCD方向について、定速伸長形引張試験機 (東洋ボールドウィン社製、テンシロンUTM-4-1-100) を用いて、試料のつかみ間隔10 cmとし、引張速度20 cm/分で伸長した。そして、得られた最大引張強力 (kg / 5 cm幅) の平均値を100 g / m<sup>2</sup> の目付に換算した値を引張強力 (kg / 5 cm幅) とした。

## [0042]

(6) Tensile strength (kg / 5-cm width) : it measured according to strip of JIS-L1906.

That is, it each made ten sample pieces whose sample length is 20 cm and whose sample width is 5 cm in vertical-direction (MD) and lateral direction (CD) of nonwoven fabric, and for every sample piece, using constant-speed elongation type tension tester (made in Oriental Baldwin, tensilon UTM-4- 1-100), it considered it as grip intervals of 10 cm of sample, and elongated by 20 cm/min of tensile velocity about the direction of MD and the direction of CD of nonwoven fabric.

And it made value which converted average value of the obtained maximum tensile strength (kg / 5-cm width) into fabric weight of 100 g / m<sup>2</sup> into tensile strength (kg / 5-cm width).

## 【0043】

(7) 透水係数 (cm/秒) : JIS-A1218に記載の定水位透水試験に基づいて、水温20℃、透水円筒の断面積3.14 cm<sup>2</sup>で測定し、透水係数 (cm/秒) を算出した。なお、透水係数が大きいほど、透水性が良いことを示す。

## [0043]

(7) Coefficient of permeability (cm/sec) : based on constant head permeability test of JIS-A1218, it measured by water temperature of 20 degrees C, and water-permeable cylindrical cross-section 3.14cm<sup>2</sup>, and computed coefficient of permeability (cm/sec).

In addition, it is shown that water permeability is so good that coefficient of permeability is large.

## 【0044】

(8) 生分解性能 : 土壌表面に敷設した防草シートを一定期間

## [0044]

(8) Biodegradable ability : after carrying out fixed period leaving as it is of the plant

放置した後、その分解状況を観察し、1～2年の間はできるだけ生分解しない方が良く、2年目以降にかけては生分解が進行するものの方が生分解性に優れるという判断で、以下の評価を行った。

protection sheet laid on soil surface, it observed these degradation situation, and for one to two years, although it is better not to carry out biodegradation as much as possible, it applies in the 2nd and afterwards and biodegradation advances, direction is decision of excelling in biodegradability, and it performed the following evaluation.

**【0045】**

○：1～2年の間は生分解せず、3年後にはほぼ完全に生分解していた。  
 △：1～2年のうちにほぼ完全に生分解していた。  
 ×：非分解性であった。

**[0045]**

CIRCLE: It did not carry out biodegradation of for one to two years, but, three years later, it was carrying out biodegradation nearly completely.

TRIANGLE: It was carrying out biodegradation nearly completely within 1-2 years.

\* : it was nondegradable.

**【0046】**

(9) 遮光率 (%) : 光源 (レフランプ) と受光部の照度計との間にシートを置き、照度 (B) を測定し、ブランク (A) との差より計算して求めた。

遮光度 (%) =  $(A - B) \times 100 / A$

**[0046]**

(9) Shading percentage (%) : it put seat between light source (reflector lamp) and illumination meter of photoreceiving part, measured illumination-intensity (B), and calculated and required from difference with blank (A).

Shading-degree (%) =  $(A - B) * 100 / A$

**【0047】**

(10) 防草効果 : 上記のように測定した遮光率の値によって、以下の評価を行った。

○：遮光率が95%以上で十分な防草効果があった。

**[0047]**

(10) The plant-protection effect : value of shading rate measured as mentioned above performed the following evaluation.

CIRCLE: There existed plant-protection effect with shading rate sufficient by 95 % or more.

**【0048】**

×：遮光率が95%未満で十分

**[0048]**

\* : there was no plant-protection effect with

な防草効果はなかった。

shading rate sufficient by 95 % less.

**【0049】****実施例1**

防草シートを形成するに際し、長繊維不織布をスパンボンド法にて作成した。まず、長繊維を形成するために、融点が171℃、数平均分子量が26000、メルトフローレート値が44 g/10分のポリ乳酸 (D/L=1.2/98.8) と、顔料としてカーボンブラックを20重量%練り混み含有したマスターバッチとを用いた。そして、顔料が熔融重合体中に0.7重量%になるようにポリ乳酸とマスターバッチとを計量配合して熔融し、孔径0.3 mmの紡糸口金を用いて紡糸温度200℃、単孔吐出量1.7 g/分の条件下で、熔融紡糸を行った。

**[0049]****Example 1**

It made long-fiber nonwoven fabric by spun bonding method when forming plant protection sheet.

First, in order to form long fiber, melting point used poly lactic acid (D / L-s 1.2/98.8) 26000 and whose melt-flow-rate value 171 degrees C and number average molecular weight are 44 g/10min., and masterbatch which carried out kneading-mixing content of the carbon black 20weight% as a pigment.

And it carried out measurement blending and melted poly lactic acid and masterbatch so that pigment might become 0.7weight% into melted polymer, and it performed melt spinning using spinneret of 0.3 mm of pore sizes on fiber-formation temperature of 200 degrees C, and conditions of 1.7 g/min of solitary-foramen flow rates.

**【0050】**

紡出糸条を冷却装置にて冷却した後、引き続いて紡糸口金の下方に設けたエアースUCKERにて牽引速度5000 m/分で牽引細化し、公知の開繊機を用いて開繊し、移動するスクリーンコンベア上にウェブとして捕集堆積させた。

**[0050]**

After cooling spun thread with cooling device, it carries out pull refinement by 5000 m/min of drawing velocities in air sucker succeedingly provided under the spinneret, and it opened fiber using fiber opening machine of public knowledge, and carried out collection deposition as a web on screen conveyor which moves.

**【0051】**

次いで、このウェブをロール温度を123℃としたエンボスロ

**[0051]**

Subsequently, it let this web pass to partial thermo-compression bonding apparatus which



ールからなる部分熱圧着装置に通して部分的に熱圧着し、単糸繊維度が3.0デニールの長繊維からなる目付が150 g/m<sup>2</sup>である長繊維不織布を得た。

is made up of embossing roll made into 123 degrees C in roll temperature, it carried out thermocompression bonding partially, and fabric weight which is made up of long fiber whose single yarn size is 3.0 deniers obtained long-fiber nonwoven fabric which is 150 g/m<sup>2</sup>.

**【0052】**

この長繊維不織布により構成される防草シートを、植物を植栽している土壌表面に敷設し、一定期間放置した後で防草シートの生分解状況および防草効果を観察した。

**[0052]**

It laid plant protection sheet comprised by this long-fiber nonwoven fabric on soil surface which is planting plant, and after carrying out fixed period leaving as it is, it observed biodegradation situation and the plant-protection effect of plant protection sheet.

**【0053】**

得られた防草シートの物性、防草効果、生分解性等を表1に示す。

**[0053]**

The physical property of obtained plant protection sheet, the plant-protection effect, biodegradability, etc. are shown in Table 1.

**【0054】****[0054]****【表1】****[TABLE 1]**



		実施例1	実施例2	実施例3	実施例4	実施例5	実施例6	実施例7
重合体 物性	素材	PLA	PLA	PLA	PLA	PLA	PLA	PBS/PBS
	融点 (°C)	171	171	171	171	171	169	115/115
	MFR値 (g/10分)	44	44	44	44	44	26	16/80
繊維物性	添加剤 (wt%)	CB 0.7	Ti 0.5	CB 0.7	CB 0.7	CB 0.7	CB 0.7	91/7 1.0/Ti 0.5
	繊維横断面	丸型	丸型	丸型	丸型	丸型	丸型	多葉型
	複合比	-	-	-	-	-	-	1/1
製造条件	単糸線度 (d)	3.0	3.0	7.0	3.0	3.0	3.1	2.9
	紡糸温度 (°C)	200	200	200	200	200	220	190
	単孔吐出量 (g/分)	1.7	1.7	4.3	1.7	1.7	1.8	1
	牽引速度 (m/min)	5000	5000	5500	5000	5000	4700	3150
	圧接温度 (°C)	123	123	123	100	123	123	85
	ニードルパンチ加工	-	-	-	2枚積層	-	-	-
	PVA付着量 (wt%)	-	-	-	-	5	-	10
操業性	冷却性	○	○	○	○	○	○	○
	開繊性	○	○	○	○	○	○	○
シート特性	目付 (g/m <sup>2</sup> )	150	150	150	200	158	150	165
	引張強度 (kg/5cm幅)	18.5	18.8	15.1	18.2	17.8	16.7	25.8
	透水係数 (cm/秒)	0.21	0.19	0.48	0.09	0.14	0.20	0.12
	透光率 (%)	99	95	98	99	99	99	99
	防草効果	○	○	○	○	○	○	○
	生分解性	○	○	○	○	○	○	○

\* PLA: ポリ乳酸

\* PBS: ポリブチレンサクシネート

\* CB: カーボンブラック

\* Ti: 酸化チタン

## Example 1-7

## Column 1 :

Polymer physical property

Fabric property

Manufacture conditions

Operation property

Sheet property

## Column 2 :

Raw material

Melting point

MFR value

Additive agent

Fiber cross section

Composite ratio

Single yarn size

Fiber-formation temperature

Solitary-foramen flow rate (g/minute)

Index temperature

Press-contact temperature

Needle punch process

PVA adhesion amount

Cooling property

Fiber opening property

Fabric weight

Tensile strength (kg / 5-cm width)

Coefficient of permeability (cm/sec)

Shading rate

The plant-protection effect

Biodegradability

Columns 3-5, 7-8: Round shape

Column 6: Round shape, two-sheet laminate

\* PLA : poly lactic acid

\* PBS : polybutylene succinate

\* CB : carbon black

Ti: Titanium oxide

#### 【 0 0 5 5 】

##### 実施例 2

カーボンブラックの代わりに酸化チタンを 20 重量%練り混み含有したマスターバッチを用いて、熔融重合体中に酸化チタンが 0.5 重量%含有されるようにポリ乳酸とマスターバッチとを計量配合した。

#### [0055]

##### Example 2

It carried out measurement blending of poly lactic acid and the masterbatch so that titanium oxide might contain titanium oxide 0.5weight% in melted polymer using masterbatch which carried out kneading-mixing content 20weight% instead of carbon black.

#### 【 0 0 5 6 】

そしてそれ以外は実施例 1 と同様にして長繊維不織布を作成し、この長繊維不織布により構成される防草シートを得た。得

#### [0056]

And other than it, it made long-fiber nonwoven fabric like Example 1, and obtained plant protection sheet comprised by this long-fiber nonwoven fabric.

られた防草シートの物性、防草効果、生分解性等を表 1 に示す。

The physical property of obtained plant protection sheet, the plant-protection effect, biodegradability, etc. are shown in Table 1.

【0057】

実施例 3

単孔吐出量 4.3 g/分とし、牽引速度を 5500 m/分とし、単糸繊度を 3.0 デニールから 7.0 デニールへと太くして長繊維を溶融紡糸した。

[0057]

Example 3

It considered it as 4.3 g/min of solitary-foramen flow rates, made drawing velocity into 5500 m/min, it made thick 7.0 deniers of single yarn sizes from 3.0 deniers, and carried out melt spinning of the long fiber.

【0058】

そしてそれ以外は実施例 1 と同様にして長繊維不織布を作成し、この長繊維不織布により構成される防草シートを得た。得られた防草シートの物性、防草効果、生分解性等を表 1 に示す。

[0058]

And other than it, it made long-fiber nonwoven fabric like Example 1, and obtained plant protection sheet comprised by this long-fiber nonwoven fabric.

The physical property of obtained plant protection sheet, the plant-protection effect, biodegradability, etc. are shown in Table 1.

【0059】

実施例 4

ロール温度を 100℃としたエンボスロールにウェブを通して熱圧着したこと以外は実施例 1 と同様にして、目付が 100 g/m<sup>2</sup> の長繊維不織布を 2 枚作成した。そして 2 枚の長繊維不織布を積層して、パンチ密度 200 個/cm<sup>2</sup> にてニードルパンチ処理を施し、目付が 200 g/m<sup>2</sup> の長繊維不織布を作成した。

[0059]

Example 4

Fabric weight made two long-fiber nonwoven fabrics of 100 g/m<sup>2</sup> like Example 1 other than having carried out thermocompression bonding of the roll temperature to embossing roll made into 100 degrees C through web.

And it laminates long-fiber nonwoven fabric of two sheets, and gives needle punching process in 200 punch densities /cm<sup>2</sup>, fabric weight made long-fiber nonwoven fabric of 200 g/m<sup>2</sup>.

【0060】

[0060]



この長繊維不織布により構成される防草シートの物性、防草効果、生分解性等を表1に示す。

The physical property of plant protection sheet comprised by this long-fiber nonwoven fabric, the plant-protection effect, biodegradability, etc. are shown in Table 1.

#### 【0061】

##### 実施例5

実施例1と同様にして目付が150 g/m<sup>2</sup>の長繊維不織布を作成した。そして得られた不織布に、けん化度99.3 mol%、重合度1000のポリビニルアルコール水溶液を含浸させた後に乾燥させ、ポリビニルアルコール付着量が5 wt%の多孔性フィルム形状の長繊維不織布を作成した。

#### [0061]

##### Example 5

Fabric weight made long-fiber nonwoven fabric of 150 g/m<sup>2</sup> like Example 1.

After letting nonwoven fabric obtained by impregnating polyvinyl-alcohol aqueous solution of 99.3 mol% of saponification degree, and polymerization degree 1000, it makes it dry. Polyvinyl-alcohol adhesion amount made long-fiber nonwoven fabric of porous-film shape which is 5 wt%.

#### 【0062】

この長繊維不織布にて構成される防草シートの物性、防草効果、生分解性等を表1に示す。

#### [0062]

The physical property of plant protection sheet which comprises this long-fiber nonwoven fabric, the plant-protection effect, biodegradability, etc. are shown in Table 1.

#### 【0063】

##### 実施例6

融点が169℃、数平均分子量が71200、MFR値が26 g/10分のポリ乳酸(D/L=1.1/98.9)を用い、紡糸温度を220℃、単孔吐出量を1.6 g/分、牽引速度を4700 m/分として、単糸繊維度が3.1デニールの長繊維を熔融紡糸した。

#### [0063]

##### Example 6

Melting point uses poly lactic acid (D / L-s 1.1/98.9) 71200 and whose MFR value 169 degrees C and number average molecular weight are 26 g/10min., it makes 220 degrees C and solitary-foramen flow rate into 1.6 g/min, and makes drawing velocity into 4700 m/min for fiber-formation temperature, single yarn size carried out melt spinning of the long fiber which is 3.1 deniers.



## 【0064】

そしてそれ以外は実施例1と同様にして長繊維不織布を作成し、この長繊維不織布により構成される防草シートを得た。得られた防草シートの物性、防草効果、生分解性等を表1に示す。

## [0064]

And other than it, it made long-fiber nonwoven fabric like Example 1, and obtained plant protection sheet comprised by this long-fiber nonwoven fabric.

The physical property of obtained plant protection sheet, the plant-protection effect, biodegradability, etc. are shown in Table 1.

## 【0065】

## 実施例7

融点が115℃、MFR値16 g/10分の高粘度ポリブチレンサクシネートと、融点が115℃、MFR値60 g/10分の低粘度ポリブチレンサクシネートとを用いて図1に示すような多葉型の横断面を有する多葉型複合長繊維1を紡糸したうえで、この多葉型複合長繊維1より成る不織布を製造した。

## [0065]

## Example 7

After carrying out fiber formation of the multiple composite long fiber 1 which has cross section of multiple as shown in FIG. 1 using high-viscosity polybutylene succinate whose melting point is 115 degrees C and MFR value of 16 g/10min., and low-viscosity polybutylene succinate whose melting point is 115 degrees C and MFR value of 60 g/10min., it manufactured nonwoven fabric which constitutes of this multiple composite long fiber 1.

## 【0066】

具体的には、高粘度ポリブチレンサクシネートと低粘度ポリブチレンサクシネートとを重量比で1:1となるように個別に計量した後、高粘度ポリブチレンサクシネートには、溶融重合体中にタルクが1.0重量%含有されるようにタルクを練り込んだ。また、低粘度ポリブチレンサクシネートには、溶融重合体中に酸化チタンが0.5重量%含有されるように酸化チタンを練り込んだ。

## [0066]

After individually measuring high-viscosity polybutylene succinate and low-viscosity polybutylene succinate specifically so that it may be set to 1:1 by weight ratio, to high-viscosity polybutylene succinate, it scoured talc so that talc might contain 1.0weight% in melted polymer.

Moreover, to low-viscosity polybutylene succinate, it scoured titanium oxide so that titanium oxide might contain 0.5weight% in melted polymer.

**【0067】**

そして個別のエクストルーダー型熔融押し出し機を用いて、低粘度ポリブチレンサクシネートが芯部2となり、高粘度ポリブチレンサクシネートが突起部3となるようにして、図1に示すような6個の突起部3を有する多葉型の紡糸口金を用いて、紡糸温度190℃、単孔吐出量1.0 g/分の条件下で熔融紡糸を行った。芯部2とすべての突起部3との重量比すなわち複合比は、1:1とした。

**【0068】**

この紡出糸条を公知の冷却装置にて冷却した後、引き続いて紡糸口金の下方に設けたエアースuckerにて牽引速度3150 m/分で牽引細化し、公知の開繊機を用いて開繊し、移動するスクリーンコンベア上にウェブとして捕集堆積させた。

**【0069】**

次いで、このウェブをロール温度を95℃としたエンボスロールからなる部分熱圧着装置に通して部分的に熱圧着し、単糸繊維度が2.9デニールの長繊維からなり目付が150 g/m<sup>2</sup>である多葉型複合長繊維不織布を得た。

**[0067]**

And low-viscosity polybutylene succinate constitutes core part 2, and it makes it high-viscosity polybutylene succinate constitute projection part 3 using individual extruder type melted extruding machine.

It performed melt spinning using spinneret of multiple which has six projection parts 3 as shown in FIG. 1 on fiber-formation temperature of 190 degrees C, and conditions of 1.0 g/min of solitary-foramen flow rates.

It was set to 1:1, weight ratio, i.e., composite ratio, of core part 2 and all projection parts 3.

**[0068]**

After cooling this spun thread with cooling device of public knowledge, it carries out pull refinement by 3150 m/min of drawing velocities in air sucker succeedingly provided under the spinneret, and opens fiber using fiber opening machine of public knowledge, it carried out collection deposition as a web on screen conveyor which moves.

**[0069]**

Subsequently, it let roll temperature pass to partial thermo-compression bonding apparatus which is made up of embossing roll made into 95 degrees C, and carried out thermocompression bonding of this web partially, and single yarn size was made up of long fiber which is 2.9 deniers, and fabric weight obtained multiple composite long-fiber nonwoven fabric which is 150 g/m<sup>2</sup>.

**【0070】**

得られた多葉型複合長繊維不織布に、けん化度99.3mol%、重合度1000のポリビニルアルコール水溶液を含浸させた後に乾燥させ、ポリビニルアルコール付着量が10wt%の微細孔を有する多孔性フィルム形状の長繊維不織布を作成した。

**[0070]**

After letting obtained multiple composite long-fiber nonwoven fabric impregnate polyvinyl-alcohol aqueous solution of 99.3 mol% of saponification degree, and polymerization degree 1000, it makes it dry. Polyvinyl-alcohol adhesion amount made long-fiber nonwoven fabric of porous-film shape which has micropore which is 10 wt%.

**【0071】**

この長繊維不織布にて構成される防草シートの物性、防草効果、生分解性等を表1に示す。

**[0071]**

The physical property of plant protection sheet which comprises this long-fiber nonwoven fabric, the plant-protection effect, biodegradability, etc. are shown in Table 1.

**【0072】**

実施例1～7は、いずれも95%以上の遮光率を有していたため、雑草の繁殖を抑え優れた防草効果を奏するものとしたことができた。また、生分解性を有する熱可塑性脂肪族ポリエステル繊維からなる不織布にて形成されていたため、土中で3年後には完全に分解しており、廃棄処理の必要のないものであった。さらに、防草シートを構成する繊維の単糸繊維度、および不織布の目付が本発明の範囲内であったため、適度な透水性が得られ、降雨などによる水がシート表面に溜まることがなかった。

**[0072]**

Since each Example 1-7 had 95 % or more shading rate, there shall exist the plant-protection effect which restrained reproduction of weeds and was excellent.

Moreover, since it formed in nonwoven fabric which is made up of thermoplastic aliphatic polyester fiber which has biodegradability, three years later, it had degraded completely by under ground, and was thing without the need for waste processing.

Furthermore, since there existed single yarn size of fiber which comprises plant protection sheet, and fabric weight of nonwoven fabric within the range of this invention, moderate water permeability was acquired and seat surface was not covered with water by rain fall etc.



## 【0073】

また、実施例1、実施例3～実施例5は、カーボンブラックが配合されていたため、植栽中の植物の保温効果に優れるものであった。実施例2、実施例7は、カーボンブラックが配合されていなかったため、カーボンブラックが配合されたものと比較すると保温性にやや劣り、植栽中の植物の成育が幾分低下したが、上述のように防草シートとしての効果は十分なものであった。

## 【0074】

実施例5は、ポリビニルアルコールを含浸させた不織布にて防草シートを構成したため、ポリビニルアルコールを含浸させていないものに較べて耐候性に優れたものが得られた。

## 【0075】

実施例7は、生分解速度の速いポリブチレンサクシネートを用いているが、ポリビニルアルコールを含浸させているので、防草効果を他の実施例と同程度の期間にわたり持続させることが出来た。

## 【0076】

比較例1  
防草シートを形成するに際し、

## [0073]

Moreover, since carbon black was mixed, Example 1 and Example 3- Example 5 were one is excellent in the heat retention effect of plant in plant.

Example 2 and Example 7 were a little inferior to heat retaining property compared with that with which carbon black was mixed since carbon black was not mixed, and growth of plant in plant fell a little.

However, effect as a plant protection sheet was enough as mentioned above.

## [0074]

Since Example 5 comprised plant protection sheet from nonwoven fabric which impregnated polyvinyl alcohol, one was excellent in weather resistance compared with thing which does not impregnate polyvinyl alcohol was obtained.

## [0075]

Polybutylene succinate with quick biodegradation speed is used for Example 7.

However, it impregnates polyvinyl alcohol.

Therefore, it was able to maintain the plant-protection effect through period comparable as other Example.

## [0076]

Comparative Example 1

It made long-fiber nonwoven fabric which does

生分解性を有しない長繊維不織布をスパンボンド法にて作成した。

not have biodegradability by spun bonding method when forming plant protection sheet.

**【0077】**

まず、長繊維を形成するために、融点が260℃、固有粘度が0.7であるポリエチレンテレフタレートを用いた。そして、孔径0.4mmの紡糸口金を用いて紡糸温度290℃、単孔吐出量2.3g/分の条件下で、熔融紡糸を行った。

**[0077]**

First, in order to form long fiber, it used polyethylene terephthalate whose melting point is 260 degrees C and whose intrinsic viscosity is 0.7.

And it performed melt spinning using spinneret of 0.4 mm of pore sizes on fiber-formation temperature of 290 degrees C, and conditions of 2.3 g/min of solitary-foramen flow rates.

**【0078】**

紡出糸条を公知の冷却装置にて冷却した後、引き続いて紡糸口金の下方に設けたエアースuckerにて牽引速度5200m/分で牽引細化し、公知の開繊機を用いて開繊し、移動するスクリーンコンベア上にウェブとして捕集堆積させた。

**[0078]**

After cooling spun thread with cooling device of public knowledge, it carries out pull refinement by 5200 m/min of drawing velocities in air sucker succeedingly provided under the spinneret, and opens fiber using fiber opening machine of public knowledge, it carried out collection deposition as a web on screen conveyor which moves.

**【0079】**

次いで、このウェブをロール温度を230℃としたエンボスロールからなる部分熱圧着装置に通して部分的に熱圧着し、単糸繊維度が4.0デニールの長繊維からなる目付が150g/m<sup>2</sup>の長繊維不織布を得た。

**[0079]**

Subsequently, it let this web pass to partial thermo-compression bonding apparatus which is made up of embossing roll made into 230 degrees C in roll temperature, it carried out thermocompression bonding partially, and fabric weight which is made up of long fiber whose single yarn size is 4.0 deniers obtained long-fiber nonwoven fabric of 150 g /m<sup>2</sup>.

**【0080】**

この長繊維不織布にて構成され

**[0080]**

The physical property of plant protection sheet

る防草シートの物性、防草効果、 which comprises this long-fiber nonwoven  
生分解性等を表 2 に示す。 fabric, the plant-protection effect,  
biodegradability, etc. are shown in Table 2.

【 0 0 8 1 】

[0081]

【表 2】

[TABLE 2]

		比較例1	比較例2	比較例3	比較例4
重合体 物性	素材	PET	PLA	PLA	PBS/PBS
	融点 (°C)	260	171	171	115/115
	MFR値 (g/10分)	0.7 <sup>(A)</sup>	44	44	16/60
	添加剤 (wt%)	-	CB 0.7	CB 0.7	9A/ 1.0/Ti 0.5
繊維物性	繊維横断面	丸型	丸型	丸型	多葉型
	複合比	-	-	-	1/1
製造条件	繊維細度 (d)	4.0	0.8	3.0	2.9
	紡糸温度 (°C)	290	200	200	190
	単孔吐出量 (g/分)	2.3	0.4	1.7	1.0
	牽引速度 (m/min)	5200	4500	5000	3150
	圧接温度 (°C)	230	123	123	95
	ニードルパンチ加工	-	-	-	-
	PVA付着量 (wt%)	-	-	-	-
操作性	冷却性	○	○	○	○
	開繊性	○	○	○	○
シート特性	目付 (g/m <sup>2</sup> )	150	150	20	150
	引張強力 (kg/5cm幅)	45.5	18.1	21.5	24.9
	透水係数 (cm/秒)	0.16	0.01	0.90	0.17
	遮光率 (%)	95	99	30	99
	防草効果	○	○	×	○
	生分解性	×	△	○	△

\* PLA: ポリ乳酸

\* CB: カーボンブラック

\* PBS: ポリブチレンサクシネート

\* Ti: 酸化チタン

\* (A): 固有粘度

## Comparative Example 1-4

Column 1 :

Polymer physical property

Fabric property

Manufacture conditions

Operation property

Seat property

Column 2 :

Raw material

Melting point

MFR value

Additive agent

Fiber cross section

Composite ratio  
 Single yarn size  
 Fiber-formation temperature  
 Solitary-foramen flow rate (g/minute)  
 Index temperature  
 Press-contact temperature  
 Needle punch process  
 PVA adhesion amount  
 Cooling property  
 Fiber opening property  
 Fabric weight  
 Tensile strength (kg / 5-cm width)  
 Coefficient of permeability (cm/sec)  
 Shading rate  
 The plant-protection effect  
 Biodegradability

Columns 3-5, 7-8: Round shape

Column 6: Round shape, two-sheet laminate

\* PLA : poly lactic acid  
 \* PBS : polybutylene succinate  
 (A): Intrinsic viscosity  
 \* CB : carbon black  
 Ti: Titanium oxide

### 【0082】

#### 比較例 2

紡糸孔径 0.3 mm の紡糸口金  
 を用いて単孔吐出量を 0.4 g  
 /分とした。そして、牽引速度  
 を 4500 m/分とし、単糸織

### [0082]

#### Comparative Example 2

It made solitary-foramen flow rate into 0.4 g/min  
 using spinneret of 0.3 mm of fiber-formation  
 pore sizes.  
 And it made drawing velocity into 4500 m/min,

度を本発明の範囲よりも小さく 0.8デニールとして長繊維を熔融紡糸した。

and carried out melt spinning of the long fiber for single yarn size as 0.8 deniers smaller than the range of this invention.

**【0083】**

そしてそれ以外は実施例1と同様にして長繊維不織布を作成し、前記長繊維不織布により構成される防草シートを得た。得られた防草シートの物性、防草効果、生分解性等を表2に示す。

**[0083]**

And other than it, it made long-fiber nonwoven fabric like Example 1, and obtained plant protection sheet comprised by said long-fiber nonwoven fabric.

The physical property of obtained plant protection sheet, the plant-protection effect, biodegradability, etc. are shown in Table 2.

**【0084】**

比較例3

長繊維不織布の目付を本発明の範囲よりも小さく  $20 \text{ g/m}^2$  とした。そしてそれ以外は実施例1と同様にして長繊維不織布を作成し、この長繊維不織布により構成される防草シートを得た。

**[0084]**

Comparative Example 3

It made fabric weight of long-fiber nonwoven fabric into  $20 \text{ g/m}^2$  smaller than the range of this invention.

And other than it, it made long-fiber nonwoven fabric like Example 1, and obtained plant protection sheet comprised by this long-fiber nonwoven fabric.

**【0085】**

得られた防草シートの物性、防草効果、生分解性等を表2に示す。

**[0085]**

The physical property of obtained plant protection sheet, the plant-protection effect, biodegradability, etc. are shown in Table 2.

**【0086】**

比較例4

実施例7と同様にして多葉型複合長繊維不織布を作成した。ただし、上記実施例7ではこの多葉型複合長繊維不織布にポリビニルアルコールを含浸させたが、この比較例4では、多葉型

**[0086]**

Comparative Example 4

It made multiple composite long-fiber nonwoven fabric like Example 7.

However, it let this multiple composite long-fiber nonwoven fabric impregnate polyvinyl alcohol in above-mentioned Example 7.

However, plant protection sheet consisted of





複合長繊維不織布にポリビニルアルコールを含浸させずに防草シートを構成した。

this Comparative Example 4, without letting multiple composite long-fiber nonwoven fabric impregnate polyvinyl alcohol.

【0087】

得られた防草シートの物性、防草効果、生分解性等を表2に示す。

[0087]

The physical property of obtained plant protection sheet, the plant-protection effect, biodegradability, etc. are shown in Table 2.

【0088】

比較例1は、構成繊維として生分解性のないポリエチレンテレフタレートを用いたため、機械的強度には優れるものの、一定期間が経過しても土中で分解することがなく、使用後にはシートを取り除く作業が必要となった。

[0088]

Since polyethylene terephthalate biodegradable as configuration fiber which is not was used for Comparative Example 1, although it excelled mechanically forcefully, even if fixed period elapsed, operation which does not degrade by under ground and removes seat used is needed.

【0089】

比較例2は、構成繊維の単糸繊維度が本発明の範囲よりも細かったため、生分解速度が速くなりすぎ、使用中にシートが分解してしまい十分な防草効果が得られるものではなかった。

[0089]

Since single yarn size of Comparative Example 2 of configuration fiber was more slender than the range of this invention, it was not that from which biodegradation speed becomes quick too much, seat degrades while in use, and sufficient plant-protection effect is acquired.

【0090】

比較例3は、目付が本発明の範囲よりも小さかったため、遮光性に乏しく、十分な防草効果が得られるものではなかった。比較例4は、実施例7と同様に生分解速度の速いポリブチレンサクシネートを用いているにもかかわらず、ポリビニルアルコー

[0090]

Since fabric weight of Comparative Example 3 was smaller than the range of this invention, it was not that from which plant-protection effect scarce light-shieldable and sufficient is acquired.

In spite of having used polybutylene succinate with quick biodegradation speed for Comparative Example 4 like Example 7, since



ルを含浸させていなかったため  
2カ月で分解してしまい、上記  
実施例1～7に比べ防草効果の  
小さいものとなった。

polyvinyl alcohol was not impregnated, it  
degraded in two months, and it became small  
thing of the plant-protection effect compared  
with above-mentioned Example 1-7.

**【0091】****[0091]****【発明の効果】****[ADVANTAGE OF THE INVENTION]**

このように本発明によれば、生  
分解性を有する熱可塑性脂肪族  
ポリエステル繊維からなる不織  
布にて防草シートを形成するこ  
とで、一定期間が経過した後の  
シートは微生物によりほぼ完全  
に分解されるため、シートを取  
り外して廃棄処理を行う手間が  
省け、しかも自然環境を汚染す  
ることがない利点がある。

Thus, since seat after fixed period elapses by  
forming plant protection sheet in nonwoven  
fabric which is made up of thermoplastic  
aliphatic polyester fiber which has  
biodegradability is disassembled nearly  
completely by microorganisms according to this  
invention, it can save time and effort which  
removes seat and performs waste processing,  
and there exists advantage which moreover  
does not contaminate natural environment.

**【0092】****[0092]**

また、ポリエステル繊維の単糸  
繊維度を1～15デニール、防草  
シートの目付を50～300 g  
/m<sup>2</sup>の範囲で調整することに  
より遮光率を95%以上とする  
ことができ、雑草の繁殖を抑え  
十分な防草効果を得ることがで  
きる。また、ポリエステル繊維  
の単糸繊維度および不織布の目付  
を上記範囲で調整することで、  
シートが生分解する際の分解速  
度を制御することができる。

Moreover, by adjusting fabric weight of 1 - 15  
deniers, and plant protection sheet for single  
yarn size of polyester fiber in the range of  
50-300 g /m<sup>2</sup>, it can make shading rate into  
95 % or more, can restrain reproduction of  
weeds, and can acquire sufficient  
plant-protection effect.

Moreover, decomposition rate at the time of  
seat carrying out biodegradation is controllable  
by adjusting single yarn size of polyester fiber,  
and fabric weight of nonwoven fabric in the  
above-mentioned range.

**【0093】****[0093]**

さらに、防草シートの透水係数  
を0.02～0.8 cm/秒の

Furthermore, it is lost that seat surface is  
covered with water by rain fall etc. by making

範囲とすることで、降雨などによる水がシート表面に溜まるこ  
 ことがなくなる。 coefficient of permeability of plant protection  
 sheet into the range of 0.02 to 0.8 cm/sec.

**【図面の簡単な説明】**
**[BRIEF DESCRIPTION OF THE DRAWINGS]**
**【図 1】**

本発明の生分解性防草シートを  
 形成する多葉型複合長繊維の纖  
 維横断面のモデル図である。

**[FIG. 1]**

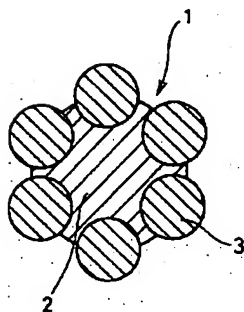
It is model figure of fiber cross section of  
 multiple composite long fiber which forms  
 biodegradable plant protection sheet of this  
 invention.

**【符号の説明】**

- 1 多葉型複合長繊維
- 2 芯部
- 3 突起部

**[DESCRIPTION OF SYMBOLS]**

- 1 Multiple composite long fiber
- 2 Core part
- 3 Projection part

**【図 1】**
**[FIG. 1]**


## **THOMSON DERWENT TERMS AND CONDITIONS**

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PTO: 2004-4330

Japanese Published Unexamined Patent Application (A) No. 02-117322,  
published May 1, 1990; Application Filing No. 63-271236, filed October;  
Inventor(s): Kiyoshi Harada et al.; Assignee: Sii Chemical Engineering,  
Inc.; Japanese Title: Coating Material for Agricultural Use

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## COATING MATERIAL FOR AGRICULTURAL USE

### CLAIM(S)

A coating material for agricultural use, to which a heat sensitive material is partially applied.

A coating material for agricultural use, on which a heat sensitive material is partially printed or coated.

A coating material for agricultural use, as cited in Claim 1 or Claim, wherein said heat sensitive material is a heat sensitive ink or heat sensitive paint.

A coating material for agricultural use, as cited in Claim 1 – Claim 3, wherein said heat sensitive material is a label, tape, or sheet.

A coating material for agricultural use, as cited in Claim 1 – Claim 4, wherein coating is done by painting or bonding.

## DETAILED DESCRIPTION OF THE INVENTION

### (Field of Industrial Application)

The present invention pertains to a coating material for agricultural use, more specifically, to the coating material for agricultural use that is partially provided with a visible heat-sensitive marker indicating the timing for air ventilation necessary for an agricultural hot house or tunnel.

### (Prior Art)

An agricultural hot house or tunnel for use in hot-house cultivation requires a ventilation when the room temperature rises in day time, but opening and closing the room takes some time and labor. In the case of using a tunnel in particular, an air-ventilation device is not installed, so the timing of air ventilation is extremely important.

Under such circumstances, a coating material for agricultural use that can easily detect the timing of ventilation has been demanded.

### (Problems of the Prior Art to Be Addressed)

To respond to such a demand, the present invention was produced to present an agricultural coating material, wherein some change detectable by a marker happens to said material when a temperature rises and exceeds a specific temperature in an agricultural hot house or tunnel.

### (Means to Solve the Problems)

The inventors of the present invention continued assiduous study to develop an agricultural coating material having said marker characteristic and found that if a heat sensitive marker is partially applied to an agricultural coating material, the marker's heat sensitive material will change its color when a temperature rises and exceeds a specific level in a room, so the timing of air ventilation can be detected by this visible change of color; thus, they produced the present invention.

Briefly put, the present invention attempts to present an agricultural coating material to which a marker made of heat sensitive material is partially applied.

As to the agricultural coating material used in the present invention, it is a sheet or film made of synthetic resin, such as: polyvinyl chloride resin, polyolefin resin, polyacrylic resin, polyester resin, polyamide resin, polyurethane resin, polycarbonate resin, polyether resin, polyether ester resin, and polyether sulfone resin; it can be properly selected from among materials that have conventionally been used as an agricultural coating material. As to said polyolefin resins, any of the following can be used: polyethylene, such as high density polyethylene, medium or low density polyethylene, or direct chain low density polyethylene; polypropylene, such

as isotactic polypropylene or syndiotactic polypropylene; copolymer of olefin with other vinyl monomer, such as polybutadiene, poly-4-methylpentene-1, ethylene-propylene copolymer, ethylene-vinyl acetate copolymer, ethylene-vinyl acetate copolymer, ethylene-vinyl chloride copolymer, or propylene-vinyl chloride copolymer. Also, the polyvinyl chloride resins include, other than single vinyl chloride polymer, copolymers of vinyl chloride with other vinyl monomer, such as vinyl chloride-vinyl acetate copolymer and vinyl chloride – vinylidene chloride copolymer. As to the polyester resins, polyethylene terephthalate and polybutylene terephthalate can be used. As to the polyamide resins, can be cited nylon 6, nylon 6.6, nylon 11, nylon 12, and nylon 6.10.

The thickness of the agricultural coating material used in the present invention needs not be specified, but generally, a 10-2000  $\mu\text{m}$  thickness, more preferably, a 20-1000  $\mu\text{m}$  thickness is used.

As to the heat sensitive material of the marker material, it is not limited as long as it can change its color, is conspicuous, has a narrow temperature range for the color change, is durable in repetitive use, does not damage the agricultural coating material, does not generate a toxic gas in thermal decomposition, and is weather-resistant in practical use. For example, a heat sensitive ink or heat sensitive paint in metal complex salt



group, organic compound group, or of liquid crystal group. As to the metal complex salt group, for example, a heavy metal iodide complex salt represented by a mercury complex salt iodide such as  $\text{Ag}_2(\text{Hgl}_4)$  [T. Note: The subscript 4 was assumed for not being legible.] can be cited. Particularly, a 2-component group consisting of  $\text{Ag}_2(\text{Hgl}_4)$  and of  $\text{Cu}_2(\text{Hgl}_4)$  is preferred. As to the organic compound group, the preferred ones are: diaryl phthalide group; polyaryl carbinol group; leuco auramine group; acyl auramine group; rhodamine B lactum group; indoline group; spiropyran group; fluoran group. Particularly, a group of crystal violet lactam with bisphenol and a group of fluoran leuco with bisphenol are preferred. These high polymer compounds are used as a binder, paint, or a printing ink in form of capsule. As to the liquid crystal group, cholesteric liquid crystal, or example, cholesteryl peragoneeto [Transliteration is provided for not being able to locate in dictionaries.], cholesteryl propionate, and cholesteryl oleyl carbonate can be cited. They indicate clear color when multiple types are mixed, and the mixing ratio can be changed to different levels to bring out the color in a proper range of temperature.

The temperature range of the heat sensitive material can be properly preset depending upon types of crops or cultivation method, but generally, 20 - 40°C is preferred, and a proper temperature can be selected from the

range of 25 - 35°C. Among these heat sensitive materials, a metal complex salt group is particularly desirable in terms of weather resistance. The organic compound group whose color change is significant in the temperature range of 25 - 35°C is properly used depending upon the use purpose, and these organic compound group materials can meet the practical purpose by using a synthetic resin to block ultraviolet ray, e.g., polyvinyl chloride, for the agricultural coating material. Also, if a drawdown agent is added to the heat sensitive material, the durability can be enhanced. As to this drawdown agent, for example, a lacquer such as nitrocellulose lacquer, or a varnish such as alkyd resin varnish, melamine resin varnish, or epoxy resin varnish, is used, particularly, a methacrylic acid group copolymer varnish is preferred.

As to the agricultural coating material, can be used, if desired, additives conventionally used for a general synthetic resin sheet or film, for example, an ultraviolet ray adsorption agent, anti-oxidant, fire-retardant agent, antistatic agent, blocking-prevention agent, and inorganic filler.

The agricultural coating material of the present invention can be produced by partially applying a heat sensitive ink, heat sensitive paint, or heat sensitive label on the agricultural coating material and applying a marker formed by characters, codes, or symbols. As to the application

method, for example, the heat sensitive paint is painted, or the heat sensitive tape, label or sheet can be bonded. As to the painting or printing method, for example, can be used a general method, such as a screen printing method, gravure printing method, off-set printing method, spray method, immersion method, brushing method, or roll coating method. The thickness of the marker is generally, 3 – 200  $\mu\text{m}$ .

(Advantage)

When the agricultural coating material of the present invention is used for a agricultural hot house or tunnel, the timing for air ventilation can be easily detected by seeing the color change when the heat sensitive marker changes its color when the room temperature rises and exceeds the specific level, which is a significant advantage.

(Embodiment Example)

The present invention is explained below in detail.

(Embodiment Example 1)

A 0.05 mm thick soft polyvinyl chloride film was used as the agricultural coating material. By using a methacrylic acid copolymer varnish, in which a 2-component complex composed of  $\text{Ag}_2(\text{Hgl}_4)$  and  $(\text{Cu}(\text{Hgl}_4))$  was mixed, for the heat sensitive ink, characters, code, and marks were printed by gravure printing, and dried. The agricultural coating

material with a marker thus produced was used for a melon cultivation tunnel and was tested. The material changed its color from a pink color to a reddish pink color at a near 35° temperature.

(Embodiment Example 2)

The agricultural coating material with a marker was made in the same method as in example 1, except that a low density polyethylene film. This material likewise demonstrated the same test.

Translations  
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Akiko Smith